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ABSTRACT

Parent involvement is considered one of the most powerful means for improving schools and for increasing the satisfaction of parents and the community. However, barriers of time, schedules, and resources have put limits on effective parent involvement. To address these problems, telecommunications technology has been applied to increase parent-teacher interaction. Voice messaging ("voice mail") is now an established way to open schools to virtually all homes, using the telephone to assure easy connectivity. The Transparent School Model, the original plan for using these linkages, can produce a high level of school-home interaction and can give positive results in student performance and parent attitudes. New technology applications are also emerging, where computer devices in the home give access to the Web, the Internet, and other resources. As cable delivery and addressable set-top devices become more available, schools can become much more open to homes and the community. With a new integrated technology model to link schools, families, and students, the barriers and gaps can be reduced or eliminated. Parents could have their choice of several delivery channels, and teachers would be able to provide remote access to the learning experience of the child with modest additional time and energy. The use of current technology to link teachers and families is feasible, and the near future holds new means of information exchange between schools and homes. (LPP)

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Applications of Technology to Linking Schools, Families, and Students

Jerold P. Bauch ■

Abstract

Parent involvement is considered one of the most powerful means for improving schools and for increasing the satisfaction of parents and the community. However, barriers of time, schedules, and resources have put limits on effective parent involvement. To address these problems, telecommunications technology has been applied to increase parent–teacher interaction. Voice messaging ("voice mail") is now an established way to open schools to virtually all homes, using the telephone to assure easy connectivity. The Transparent School Model, the original plan for using these linkages, can produce a high level of school–home interaction and can give positive results in student performance and parent attitudes. New technology applications are also emerging, where computer devices in the home give access to the Web, the Internet, and other resources. As cable delivery and addressable set-top devices become more available, schools can become much more open to homes and the community. With a new integrated technology model to link schools, families, and students, the barriers and gaps can be reduced or eliminated. Parents could have their choice of several delivery channels, and teachers would be able to provide remote access to the learning experience of the child with modest additional time and energy. This paper looks into the near future at new means of information exchange between schools and homes while demonstrating the feasibility of using current technology to link teachers and families.

■

Introduction

Children in many American schools can interact with children in other schools around the world using one of several linking strategies (e.g., e-mail, the Internet, fax, or even the ubiquitous telephone). But their families will never know that these exciting events happened unless the students tell them. Seigenthaler (1996) reminded us of the power and the potential: "With each new advancement, communications technology moves us closer to relationships with peoples and cultures across the globe" (p. xiii). The problem is that we are not using equally powerful strategies to communicate with the people across the street.

When parents ask their child "What did you do in school today?" it is because they sincerely want to know. It also shows that there is no easy access to the information from any other source. Of course, it is true that schools *try* to keep parents informed. But limitations of time, schedules, distance, and resources prevent school–home communication from being either *universal* or *comprehensive.* If there were universal links between schools and homes, every family would have easy access to information about their child's daily school experience. If the links were comprehensive, the family could learn exactly what it needed to know to provide a supportive learning environment at home. These conditions are available in only a few schools, but there is a clear need to build more effective partnerships between school and home (Comer, 1986; Epstein, 1992; Henderson & Berla, 1994).

In a recent poll of registered voters conducted by the National PTA, 94% said that educational progress depended on involving parents in the process. Other national surveys also show surprisingly high consensus that schools and homes

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should increase interaction and collaboration. In 1997, the Gallup Poll reported that 86% of the general public believes that support from parents is the most important way to improve the schools (Rose, Gallup, & Elam, 1997). This attitude has been stable over the past decade. The 1984 Gallup Poll identified "lack of parental involvement" as the biggest problem facing the public schools (Ost, 1988).

The research literature agrees that effective parent involvement can be more effective than any other strategy for improving the schools ("School Reform and Parents," 1997). Henderson and Berla (1994) summarized more than 85 studies that document the profound benefits for schools, families, and students when parents participate in their children's education. Bill Gates of Microsoft emphasized the importance of this relationship when he stated: "The vision here is of a connected learning community. The connection between the school and the home is very valuable" (Gates, 1997). The power of the home was emphasized by Walberg (1984) in his review of 29 studies of school–parent programs. He found that family participation in education was *twice* as predictive of students' academic success as family socioeconomic status. Some of the more intensive programs had effects that were *10 times* greater than other factors.

When parents and teachers have rich and frequent communication, they can begin to forge the partnership that produces these benefits. The first step toward active participation for families is a common information base with schools.

This paper describes new uses of technology that can give schools, families, and students access to the same information on a regular basis. It then looks just around the corner at emerging technologies that have the potential to enrich the linkage. As we approach the turn of the century, it is vital that the barriers and gaps between schools and homes become much more permeable. The free flow of information can be accomplished through current and future connectivity, and the emergence of integrated strategies can improve the ways that teachers and family members exchange information (Kantor & Harrington, 1997).

The Recent Past

Voice Messaging for Parent Involvement

The first schoolwide applications of voice-messaging technology (commonly called voice mail) were developed in 1987 (Bauch, 1989; Ordovensky, 1989) and have been the dominant technology linkage in school–home communication. The first experiments resulted in a model that could be used in any school, and the plan was named the Transparent School Model. The name implies that we are using technology to make the school program "visible" to the parents, although the actual channel is voice, not vision.

On any given school day, the model works like this:

1. At the end of the day, the teacher reflects on the learning experience and writes a brief script for a message to parents.
2. The teacher picks up any (tone-based) phone and dials the school "hotline" number.
3. After entering his or her secure voice mailbox, the teacher records a 60- to 90-second message.
4. Parents may call the school "hotline" number and select the mailbox for their child's teacher or section.
5. After listening to the message, the parent has the option of leaving a response or question for the teacher.

When fully operational, every teacher has at least one voice mailbox and records a message every day describing the learning experiences of the group. The message includes a number of elements, including positive news from the classroom, explanation of content and concepts, specific homework assignments, and suggestions to parents.

The best applications also include the capability for the school to make automated calls *to* parents. In this process, an administrator or teacher records a message and selects the parents to be called. A general reminder about a parent meeting might be sent to all families, or a teacher might have the system call parents in one class with a schedule change or other nonroutine information. Schools use this "call-out" function to send good news home, for attendance or emergency notification, to promote other parent involvement, and for many other creative applications.

In the Transparent School Model, parents can call and listen to teachers' daily messages at any time from any phone. The school can also deliver phone messages to any combination of parents whenever necessary. Two-way communication is easy, and

time delay makes it extremely convenient. The technology makes every minute count, and count many times. The carefully crafted daily messages enable parents to take an active and influential role in their child's learning.

The Technology for Voice Messaging

Way back in 1987, our first trials used simple answering machines and separate phone lines to classrooms. Teachers simply recorded their messages where the "greeting" would be, and parents called a specific number for a teacher's message. This "Generation I" application also used a computer-based autodial card in the office computer to manage the outcalls. Although this configuration allowed us to identify and improve the functions for the model, the primitive technical systems were hardly satisfactory for use in all of the nation's schools.

Generation II followed quickly, where we experimented with more powerful voice mail from a central source. Service bureaus and phone companies had elaborate voice-mail capabilities, and the economies of scale were interesting. We found that schools were not comfortable with the abstract nature of service from a remote site and that voice-mail systems designed for large businesses had limited value in the school setting. Remote services also had difficulty in providing data on usage rates and other feedback to schools, which proved to be important as motivation for teacher use.

After several trials with the "remote server" configuration, integrated voice-messaging systems designed for school use in a PC platform were appearing on the market. These systems could be site-based, customized for the individual school, and had advantages in the messaging functions that schools wanted and needed. The best arrangement for these "Generation III" systems was to have one PC that managed all voice-mailbox functions and provided the automated outcall capability for a school. The systems collected and stored their own data on these functions and were a useful source of evaluation information on teacher and parent use. For example, if a teacher placed an automated outcall to members of the class, the system could display (and print) the results of the calling. The listing would show if any homes did not receive the message by indicating either "busy" or "no answer" in the report. Student information was organized in a database, and the calling list could be assembled with a few key strokes.

In Favor of Telephone Technology

Throughout the three-generation history of the Transparent School Model, we chose to use the telephone as the device for both teachers and parent users. The telephone had all the advantages of familiarity, easy use, and widespread availability. The computer-based voice-messaging systems that managed the communication were quite sophisticated and were relatively invisible to the users. In 1993, 94% of American households had telephones, and another 1.3% had easy access to a phone (Schement, 1994). With this "penetration" rate, we could approach the condition of *universal* communication between classrooms and homes. The presence of telephones in almost all homes reduced the possibility of technology inequity based on economic status—a serious problem with many other telecommunications approaches.

One small problem with the telephone as the input/output device is that teachers are the very last professionals to have one (Poirot & Robinson, 1994). The Transparent School Model does not *require* a phone in every classroom, but it would certainly improve the convenience for teachers. The new education rate (E-rate) discounts (Trotter, 1996; Vail, 1996; Brittain, 1997) should help schools add phones for school–home telecommunications.

Evaluation Outcomes

We have conducted a number of experiments, pilots, evaluations, and research studies on the use of voice-messaging technology for parent involvement. Many schools in diverse settings across the country have contributed data and been part of these studies that were supported by private foundations, telephone companies, and the business community.

Our first step was to establish a baseline on the nature and level of school–home interactions before putting the Transparent School Model in place. We sampled all contacts of all types for all teachers in each school over a 10-day period and found remarkable similarities from school to school. The mean number of parent contacts (all types) per teacher per day in America's schools ranged from 2.1 to 2.6. Two or three families had some interaction on a given day; the rest had none. This statistic translates into less than 10% of the families having even a casual interaction with their child's

teacher daily. The differences between schools were also in a narrow range, with high schools usually showing the lowest teacher–parent communication rates. In a relevant study of 1,032 parents, Marttila (1995) found that the median rate of parent–teacher conversations was 4.0 *per year.* The parents in that study also placed higher value on their roles supporting their child's learning *at home,* not school-based parent involvement.

After gathering "pretest" information on the nature and frequency of parent–teacher interactions, the model was put in place. When the technology was used by most or all teachers daily and the model was fully implemented, the daily exchange of information from school to homes often increased by 500 to 800%. In our most recent trial with more than 60 schools reporting data, the mean contact rate rose by 487% (Bauch, 1997). One of the school systems improved parent contact rates by 950%! It is now typical for about half of the families in the school community to call and listen to a teacher message every day. Schools that make extensive efforts to encourage parents to call have approached a calling rate where 75% of the families call daily.

Once schools fully implement the model, many of the other expected outcomes of improved communication appear. For example, teachers report higher homework completion rates. Homework completion allows more accurate grading and better grades, as the "zeros" disappear. Walberg, Paschal, and Weinstein (1985) showed much higher achievement when students complete homework. Another independent study showed a clear change in student grade point average (GPA) after installing a hotline (Fulk, 1993). There was a 22% reduction in the group that had very low GPAs (therefore reducing school failure) and a 22.6% increase in students who became eligible for academic honor roll designation. Fewer low-performing students and more students with high performance are exactly the kind of changes that are needed in every school.

There have been two controlled studies of student achievement—one in Tennessee and another in Indiana. In both, schools using the model were matched with schools that had very similar student/family/neighborhood demographics. After being assured that the "hotline" schools and the contrast schools had similar parent involvement histories, we compared school means on the California Achievement Test. In both cases, there were definite statistically significant differences in favor of the schools using the Transparent School Model. While we must be careful about attribution, it seems logical that when school–home communication jumps from under 10% to more than 50% per day, overall student performance will improve (Henderson & Berla, 1994; Moles, 1993).

Another important outcome area is parent attitudes. It seems apparent that as information flow between schools and homes grows, the attitudes of parents improve. This effect was documented by Ames, Khoju, and Watkins in the Johns Hopkins study of parent beliefs and attitudes (1993). The 1997 Gallup Poll confirms this relationship, indicating that the general public is more positive about the schools they know best. In our samples from many schools in diverse settings, parent attitudes became more positive as calling frequency increased. The "frequent callers" (three or more times per week) were almost six times more positive about the school and their child's performance than parents with little or no contact. The parents who received little or no information from the school tended to have attitudes that were neutral to negative. Parent support is a critical element in collaboration and positive community relationships and can be improved by simply providing easy access to accurate information about the school.

New Partnerships: The Bridge Project

After demonstrating quite clearly that voice-messaging technology can forge a new communication linkage for teachers, parents, and students, the model captured the interest of the business community. In 1995, the American Business Collaboration for Quality Dependent Care (ABC) adopted the Transparent School Model as a way to provide special benefits to employees with children in the schools. The ABC is made up of 22 "Champion," or lead, companies such as Allstate, Exxon, IBM, and Lucent. Acting through Boston-based Work/Family Directions (WFD), these large employers wanted a program that would improve school success while helping working parents increase their positive roles with their school-age children. The Bridge Project became a way for the employer to spend employee benefit funds to reduce family stress and contribute to the quality of education locally.

The Bridge Project Context

WFD helped designated communities acquire the technology and implement the project based on the original Transparent School Model. WFD also selected Homework Hotline Educational Services in competitive bidding as the vendor of the technology, installation, and training. In the first pilot round of the Bridge Project, 102 schools qualified, and each received an award of about $15,000 to fully implement the project. More than 85,000 families benefited from the program, and it received widespread media attention. Stories appeared on the *Today Show*, in national print media such as the *Christian Science Monitor*, and dozens of local outlets. In 1996, the project won the prestigious "Golden Apple" award from the U.S. Department of Education and *Working Mother* magazine. This new business/technology/school partnership is currently in an expansion mode, and new communities are being added.

Bridge Impact

Among the very positive results of the 1995-97 Bridge pilot period were the reactions from the working parents with children in project schools. About 87% of the employee families used the system during the first year of the project, and 78% were "satisfied" or "very satisfied" with the new services. Perhaps the best news was that once they found out that they had such easy access to vital school information, fully 89% of the parents wanted to keep the project as a regular way for schools to keep parents informed. An interesting concomitant effect was also found—over 70% of employees felt more positive about their employer for providing the model in their local schools.

Voice Messaging Prologue

With 2,000 to 3,000 schools using the functions of the original Transparent School Model or new Bridge Project configuration, and the high consistency of evaluation results, we have an effective strategy for using technology to link schools and homes. Voice messaging has the advantages of using a low-tech but ubiquitous device (the telephone) backed up by sophisticated computer-based technology. Other advantages are:

- instant ease of use (1 to 2 days from amateur to expert)
- application in any school in any setting
- extremely modest costs per unit of communication
- high convenience for both teacher and parent users
- time delay to match complex family schedules.

Since all surveys find that lack of time (e.g., Marttila, 1995) and mismatched schedules are the most serious barriers to better parent involvement, the model appears to transcend these deterrents.

Voice-based links using the telephone are likely to have a relatively long and durable future because most of the emerging technologies must wait for penetration of the home market before approaching universal applications. For example, the frantic expansion of Internet-based links is still years away from being universally available in homes (especially in low-income homes). The National Center for Educational Statistics reported that only 65% of schools had access in 1996 (Conte, 1997) and projected that access would reach 95% by the year 2000. But availability of service in school does not assure the connection to homes. Jupiter Communications (1997) estimated that only about 12 million homes had Internet access in 1996 *but only about three million homes had actual usage by children and family members.* (There are about 19 million households with children.) Jupiter predicted a steep jump to usage by about 15 million homes by the year 2000—still a significant distance from the almost universal presence of the telephone in 1997. This slow rate of gain may change if cable modem availability gives homes access to the Web without requiring a $2000 computer system.

Emerging Ideas for Tomorrow

Now that we know that current technology can make the school program accessible to families, and that both teachers and parents will use technology for routine information exchange, what is next? Charp (1997) listed six current applications—three were phone based, two involved interactive television or video, and the sixth was home use of the Internet. In this section, we will sample some of the other emerging applications and speculate on an integrated model that could maximize the relationship between schools and homes.

What's New?

There are new applications of "off-the-shelf" technologies, newly developed delivery systems, and very interesting new programs designed to blur the

demarcation between school and home. This sampler is presented in no particular order of importance, and some specific examples are provided to illustrate the movement.

- *School software licensed for home use.* CUC Software now allows its popular educational software to migrate to homes so parents can "play a stronger role in their children's day-to-day education."
- *Teacher electronic planning and grade recording programs.* These programs are beginning to include files of home letters, records of parent contacts, and alternative progress reporting formats to enrich communication with parents.
- *School technology for parent use.* Schools are opening their doors to parents so school-based technology (especially Internet) can be used by family members. The AT&T Foundation funded a large project in Los Angeles County for 25 parent-accessible regional technology centers.
- *Selecting higher education.* Schools have used video, interactive videodiscs, and CD-ROM programs to help parents and students make college selections. Internet access from the guidance office (or from the home if the family has a computer) to the home pages of any university is becoming the norm as parents and students plan their next educational endeavors.
- *Internet linkages.* There are many initiatives to use the Internet (and e-mail) for school–home communications. Some groups (e.g., Family Education Network) offer any school in the country a free Web page and links to their other family resources. Conversely, virtually every parenting organization and publication also makes information available to families on the Web. IBM has been extending Internet exchanges between teachers and parents at the Governor's School in Charlotte, North Carolina, for more than two years as part of their "Reinventing Education" program. Although clearly a pervasive and powerful force for school–home communication (Trotter, 1997), the Internet demands a computer or other special device at the user end—a severe limitation for a universal connection.
- *Take-home technology.* By emulating Indiana's "Buddy Project" (Pick, 1996) where students and their families were given a computer for their home use, we can partially overcome the need for expensive equipment. For example, the exciting new Lightspan Partnership uses interactive video curriculum material in the classroom and sends a Sony Playstation CD-ROM unit home. Students and family members can collaborate on home-designed learning experiences using the CD-based programs on their own television set. Take-home laptops proved to be valuable for students in the "at-risk" category in Houston (Smith & Anderson, 1994), stimulating higher interest in education for students and their families.
- *Technology for home schooling.* Families who elect to educate their children at home use PCs and other technology to support their instruction. The Heller Report (1996) reported one survey where 67% of home schoolers had computers in their homes (a much higher rate than parents of school-age children in general). Instructional software and Internet access are typical uses, but there are also online courses to help parents learn to teach, online curricula, and even electronic magazines for the home-schooling community.
- *Video classroom observations.* First pioneered as a way for anxious parents to peek into their child's day care center, this Web-accessed video runs continuously. Parents can log on, look in, and feel reassured. The application can be used in any classroom (or even home care) situation and makes the learning experience visible to the parent from any computer with Internet capability. The "I See You" program broadcasts still pictures every 30 seconds; others go for 60-second shots, and ParentNet gives six frames per second over ISDN (Gorena, 1997). Full motion video cannot be far behind.
- *Opening the library.* Some schools are allowing parents with Internet computers to have electronic access to their library and other library resources in the school district. Community Internet Link, for example, uses a standard Web browser to help parents and students manage searches from home.
- *Electronic portfolios and report cards.* With the advent of portfolio assessment of student progress, it was inevitable that portfolios would move from folders to diskettes and video (Lankes, 1995). The Burris Laboratory School

in Muncie, Indiana, produces a "Video Report Card" using regular video cameras and tape (Greenwood, 1995). Others are using student portfolio software, which can incorporate voice, data, and video to show parents their student's performance in school.

These samples represent a lot of good ideas, often piloted on a very small scale, that have been slow to approach universal application or comprehensive information access. We believe the time is ripe for a fully integrated system of technology-supported school–home links that can permeate the walls that have divided these two institutions.

A Proposal for an Integrated Model

Imagine a parent returning home after a day at work and wanting to find out what their child did in school. The parent might touch the "on" button on the television remote control and hear:

> *"Good afternoon, Mr. Martin. We have two messages for you from school today. If you would like to hear them, touch or say one. If you would like to have them displayed on the screen, touch or say two. If you would like them placed in your e-mail file, touch or say three. If you would like a hard copy, touch four for fax delivery."*

After choosing the delivery mode, the parent listens to or reads the message. If the teacher's message specifies particular homework, the message may continue:

> *"In the earth science lesson, students are learning about the structure of the earth. We distributed a worksheet, and they are to label the layers. If your child does not have the worksheet, you may have it displayed on the screen, filed in your e-mail, or received on your fax machine."*

This communication method could provide two levels of family support that are currently unavailable—easy access to information about the school experience and a way to acquire the needed homework materials at home.

To carry the notion further, the menu could include a series of "help for parents" items. These could be content summaries (e.g., a refresher on the geology of the earth), home learning management ideas (e.g., "Why not divide the homework tonight into three smaller periods?"), and even parenting suggestions (e.g., how to set cooperative limits on television viewing). This category could include "parent primers" on everything from at-home study skills to reviews of this week's educational television offerings. Some of these items would be semi-permanent, and others could be pertinent to the current learning experience.

A next step would be to give parents access to the actual classroom experience. One choice in the menu would be to give either a "live" view into the classroom (during school hours) or a series of significant snapshots of what happened in the classroom today. For example, a teacher using cooperative learning strategies might provide a brief "quick time" video of a group of students pooling their knowledge to solve complex problems.

A new integrated technology model like this would also give parents direct access to student progress information, including grades, other evaluations, and online student performance portfolios. Each home could learn more about their child's teachers by accessing their personal/professional home page and (with time delay) could exchange messages by any of the available channels. It is conceivable that parents could leave a full-motion video message from home or elect to use simple voice or e-mail.

In direct support of student learning, the new model would give students everything from access to online searches (e.g., "Ask Dr. Math" or "KidsConnect") of area educational resources to multiple-channel ways to interact with teachers, counselors, and content experts. Students would also be networked with each other, so "studying together" could take on a whole different meaning.

Advantages and Limitations of the Integrated Model

If we decided to close the gap and knock down the walls that prevent parents and teachers from forging effective partnerships in support of the child's education, the means are at hand. From the home side of the equation, all of the devices and services mentioned above are readily available (although currently too expensive for every home). This idea takes into consideration the needs of the family and the student to maximize the home learning environment and responds to some of the complexity and circumstances of today's diverse families.

On the technology side, the model will probably depend on how rapidly the "set-top box" and other cable delivery systems expand (Mannes, 1995) or another broadband connection emerges. The

integration of video conferencing to current capability would enrich the exchange. In the foreseeable future, an integrated cable delivery is the most likely pipe to use for this interchange.

In this case, the home could be ready to connect faster than the schools are to send. This integrated model implies that every classroom would have video conference capability, multiple access channels, and network hookup within the school and to the community. It will depend on small increases in teacher energies to package and send information home and a philosophical commitment that opening the classroom to the home is an important and valuable endeavor.

Synthesis

Voice-messaging technology using the telephone can open any school in America to the homes of the students. These models are dependable, easy to use, and cheap. With a few jumps in integrated cable technology and the integration of functions, the home could have a greatly enriched exchange of information with schools. With vision, collaboration, and cooperation, every student's home and school could form new synergies on the way to true learning communities.

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